

NEW JERSEY MARITIME RESOURCES
An Agency of Prosperity New Jersey
and the
New Jersey Commerce and Economic Growth Commission

MEMORANDUM

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TO: Frank M. McDonough, Executive Director
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FROM: Lisa Baron, Maritime Specialist

SUBJECT: Restoration of the Passaic River

In the past, the restoration of contaminated sediments in the Passaic River was believed to be impractical due to extremely high associated costs (i.e., ACOE projected \$4 billion price tag). Based on newly developed decontamination technologies, dredging techniques, beneficial use applications, and a significant decrease in the cost of dredged material management, the implementation of restoration activities in the Passaic River is now feasible and cost effective. A first level cost analysis of approximately \$460 million is projected for the removal of contaminated sediments and habitat restoration in the six navigational reaches of the Passaic River (downstream to the Newark Bay confluence). This restoration proposal would result in substantial ecological and economic benefits, including:

- A significant reduction in the overall contaminant load in the Passaic River and other areas of the estuary;
- Minimization of ecological and human health risks in the Passaic River and other areas of the estuary;
- An increase of the amount of sediment acceptable for ocean disposal at the HARS;
- A subsequent substantial cost savings to the navigational dredging program;
- Beneficial use of the dredged material for waterfront development and local infrastructure; with
- Subsequent economic benefits to the towns of Harrison, Belleville, Kearny, Newark, Bayonne, and Jersey City.

Based on the contaminant distribution identified in sediments within the river, the greatest economic and ecological benefits (listed above) would result from the removal of contaminated sediments within the entire six-mile study area of the Passaic River. However, if total funding is not appropriated for the restoration of the entire six-mile study area, "hot spot" removal of highly contaminated sediments may be implemented. A segregated cost of approximately \$252 million is predicted for highly contaminated "hot spot" removal from Harrison Reach (adjacent to the former Diamond Alkali facility). While under this scenario substantial economic benefits to the Passaic

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River region would be realized, much of the benefit to the dredging program in the Newark Bay complex would likely be lost.

This memorandum summarizes data on chemical concentrations in the Passaic River, restoration options, decontamination technologies, projected costs, challenges, and future steps for the implementation of restoration activities on the Passaic River.

1.0 BACKGROUND

Field investigations conducted since 1985 have reported the presence of toxic substances including dioxins (particularly 2,3,7,8-tetrachlorodibenzo-p-dioxin [TCDD]), polychlorinated dibenzofurans (PCDF), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), DDT, and trace metals in sediments of the Passaic River. Many of these Chemicals of Concern (COCs) pose a risk to ecological resources and humans in the Passaic River and the NY/NJ Estuary. Contaminated sediments in the Passaic River have been transported and continue to migrate to Newark Bay and other areas of the estuary. These COCs (specifically TCDD, DDT), originating from the Passaic River, impact the ecological health and economic viability of the Port of NY/NJ.

Sediment containing TCDD is especially problematic for federal navigational and private berthing dredging disposal/placement options. Based on bioaccumulation data, dredged material in the harbor containing TCDD in excess of approximately 30 parts per trillion (ppt) in the sediment typically fails classification for ocean placement at the Historic Area Remediation Site (HARS). The management of material unacceptable for HARS is much more costly (\$29/cubic yard [cyd]) when compared to unrestricted ocean placement (\$3-8/cyd). Therefore, the reduction in contaminant loadings in sediments to “clean” levels will result in more dredging projects suitable for ocean placement at significant savings. The realized cost/environmental benefit of implementing the current Contaminant Reduction Assessment Program (CARP), as stated in the Dredged Material Management Plan (DMMP) (September 1999), is over \$850,000,000 over the 40 year planning period. Further reduction of contaminant loadings in the harbor, as a result of dioxin hot spot dredging would increase and accelerate this tremendous cost saving. Specifically, navigational channels including Newark Bay, the Arthur Kill, Kill van Kull, Hackensack River, and Raritan River would be positively affected over time. The Harbor Modeling Program, part of the Harbor Estuary Program (HEP), will evaluate the predicted contaminant loading over time within these areas of the Estuary.

Historical (1984-1994) and recent investigations (1995) identified TCDD concentrations within all navigational reaches and shallow mudflats of the Passaic River. The ranges of surficial and maximum concentrations at depth within each reach are presented in Table 1. The highest concentration (60 parts per million (ppm) at 5 ft)) was found in sediments within the Harrison Reach directly adjacent to the former Diamond Alkali Facility, located on 80 Lister Avenue (Site). Historical dioxin releases (1950s and 1960s) from this facility based on radiogeochemistry dating as well as elevated TCDD and metal concentrations within the waterway adjacent to the Site, shows that the Site is an apparent source of TCDD in sediments of the Passaic River, Newark Bay and possibly in several other areas of NY/NJ harbor. Subsequently, the six-mile stretch of the Passaic River (i.e., 3-miles upstream and downstream of the Site) is in the process of a remedial investigation/feasibility study (RI/FS) pursuant to the Superfund Program. This six-mile stretch is designated by Superfund as a “riverine study area” or Operable Unit 2. A distinct “hot spot” is

evident adjacent to and downstream of the Site where historical discharge spills and depositional processes have contributed to the elevated TCDD concentrations. (Figure 1).

Table 1
2,3,7,8 -TCDD Concentrations in Sediments of the Passaic River (6-mile Study Area)

Navigational Reach	2,3,7,8-TCDD Concentration (0-2 inches: ppt)		2,3,7,8-TCDD		Dredging Depth (Rationale)
	Min	Max	Maximum Concentration (ppt)	Depth (ft)	Maximum Concentrations with Depth
Point No Point (Downstream confluence)	85	1,000	11,900	4	16 ft <ul style="list-style-type: none"> 14 ft: 516 ppt TCDD 15 ft: ND
Harrison Reach (East) – Site	202	13,500	60,000,000	5	19 ft <ul style="list-style-type: none"> 15.8 ft: 151 ppt TCDD 17 ft: 7.8 ppm Mercury
Harrison Reach (West) –Site	11	9,700	596,000	13.2	19 ft <ul style="list-style-type: none"> 16 ft: 28 ppb TCDD 17 ft: 51 ppt TCDD
Newark	3.5	5,500	32,000	10	15 ft (Conservative) <ul style="list-style-type: none"> No data collected below 10 ft (with 32 ppb TCDD)
Kearny	80	6,600	26,000	2	10 ft (Conservative) <ul style="list-style-type: none"> 5 ft: 2 ppb TCDD (1984-89 data) 7 ft: 5 ppt TCDD (1995 data) No data collected below 7 ft.
Arlington (Upstream)	21	630	32,000	2	10 ft (Conservative) <ul style="list-style-type: none"> Hot spot of TCDD at 2 ft 4 ft: 31 ppt

2.0 RESTORATION ACTIONS

The removal of contaminated sediments within the Passaic River would result in the significant reduction of chemical exposure to humans and ecological receptors in the Passaic and potentially in many other areas of the NY/NJ Estuary. By initiating an environmental dredging program in the Passaic River, a significant contaminant mass indicative of a historically industrialized waterway would be removed. Contaminants found in sediments targeted for removal would no longer be transported to Newark Bay. This would reduce the overall dioxin inputs to the system and potentially increase significantly the amount of HARS suitable navigational dredged material throughout the Harbor.

Realistically, point and non-point sources will continue to input contaminants to the waterway. However, bi-state and federal pollution prevention programs already underway in the short to long term will reduce these contributions significantly to the Passaic River. The proposed remedial action, in conjunction with these programs, will reduce the total mass load to the Passaic River possibly rendering these sediments “acceptable” for placement at the HARS or beneficial use when subsequent dredging is required.

Furthermore, there are substantial economic benefits to the area surrounding the Passaic River. The City of Newark is undergoing a “renaissance”. With the newly constructed NJ Performing Arts Center, the return after 40 years of the Newark Bears Independent League ball club, the Joseph G. Minish Historical Waterfront development and surge of brownfield restoration projects, the restoration of the Passaic River is the “anchor” and economic driver for further development in this corridor. Towns of Harrison, Belleville, Kearny, Newark, Bayonne, Jersey City would benefit by this restoration.

For the purpose of this scoping document, two restoration option scenarios are presented in the following sections.

2.1 Restoration Option 1

Restoration Option 1 includes the removal of sediment within the entire six-mile study area of the Passaic River. The total volumes to be removed from each Federal Navigation Reach are based on the chemical concentrations measured in the sediments collected from historical investigations during 1984 to 1995 (Table 1). These data included surficial through depth (sediment cores) chemical concentrations. Table 2 presents the dredging footprint and total volume of sediment to be removed from each reach.

In Restoration Option 1, a total of 10,074,247 cubic yards of sediment would be dredged from all reaches in the river. The remedial area was defined as the area that contains sediment at concentrations of dioxin greater than approximately 30 ppt. This concentration is the estimated bulk sediment concentration typically results in 1 part per trillion (ppt) or greater bioaccumulation in the sandworm. It was assumed that the removal of the dioxin would also include many other COCs contributing to contaminant loading and risk. However, an increased dredging depth of 19-ft in the Harrison Reach was suggested due to the high levels of mercury found at 17-ft depth. Two feet of

overdredge was added to the dredging depth to ensure complete removal of contaminated materials. Figure 2 presents a conceptual diagram of the contaminated sediment within the six-mile stretch that would be removed.

The sediment would be incrementally excavated starting in the upstream reaches of the river. A sediment migration control system, such as a silt curtain, would be installed downstream of the river. In addition, current best management practices would be implemented to minimize the resuspension of sediments during dredging activities. Dredging under low flow conditions would be most preferable. The sediment would be dewatered (if necessary) and decontaminated using several existing technologies that have commercial scale applications.

Technology Options

Based on previous experience, thermal destruction technologies work best for the decontamination of sediments containing high levels of dioxin and organic chemicals. Moderate to less contaminated sediments, found in the Arlington, Kearny, and Point No Point Reaches, might also be decontaminated using a non-thermal sediment washing technology. Decontamination would generate high value beneficial use end products such as manufactured grade cement, lightweight aggregate [LWA], manufactured soil, or architectural tiles. These beneficial use products could be used for local riverfront and downtown Newark (adjacent communities) re-development, enhancement and restoration projects. Waterfront Development Programs in the Newark area, such as Minish Park, could utilize decontaminated amended dredged material. Material could also be used for landfill closure and brownfields restoration, habitat creation/restoration or in transportation projects such as the NJ Transit light rail expansion in Jersey City.

Table 2
Dredging Footprint for the Passaic River

Reach (Prioritized¹)	Length (ft)	Width (ft)	Depth (ft)²	Total Volume (cyd)
Harrison Reach (East) –Site	4,500	675	19	2,137,500
Harrison Reach (West) –Site	6,600	525	19	2,438,333
Point No Point	6,563	750	15	2,734,583
Newark	7,775	437.5	15	1,889,757
Kearny	5,200	400	10	770,70
Arlington	700	400	10	103,704
Total	31,338 ft (5.94 miles)			10,074,247

¹ Reaches are prioritized in the order of importance for remediation. The order reflects the most contaminated to the least contaminated reach.

² Dredging depth is determined based on contaminant concentrations presented in Table 1.

2.2 Restoration Option 2

The second restoration option is the prioritization of the reaches for remedial actions. The most contaminated sediments, such as those found in the Harrison Reach, would have first priority status and be removed first. If appropriations are available, the other reaches would be remediated in the order specified in Table 2 (in the order of descending contamination levels). The removal of the most contaminated sediments (maximum of dioxin 60 ppm) would result in a minimization of overall risk and contaminant loading within the harbor. The sediments would be decontaminated and used in a similar manner to that discussed in Restoration Option 1. Option 2, however, would unlikely result in an immediate economic benefit to the Port and Port community. If contaminated sediments from the remaining navigational reaches are not removed from the Passaic River, sediments containing dioxin (and other COCs) would continue to be transported to Newark Bay and impact the Navigational Dredging Program .

2.3 Environmental Monitoring

Environmental monitoring must take place following the implementation of the dredging activities. After the removal of contaminated sediment, sediment samples would be collected for chemical and toxicological analyses. Exposed sediment would be tested to determine the adequacy of the dredging depth. The remaining sediments would contain sufficiently low chemical concentrations that would subsequently pass ocean disposal requirements in the future. Therefore, any sediments that were transported to Newark Bay and other areas of the estuary would meet classification criteria for ocean disposal at the HARS.

3.0 ASSOCIATED COSTS

The costs associated with dredging the reaches of the Passaic River are presented below in Table 3.

Table 3: Restoration Option Costs

Reach (Prioritized)	Volume (cyd)	Activity	Technology	\$Cost/cyd¹	\$ Total Cost
Harrison Reach (East)	2,137,500	Dredging	NA	5/cyd	10,687,500
		Decontamination	Thermal Destruction	50/cyd	106,875,000

Harrison Reach (West)	2,438,333	Dredging	NA	5/cyd	12,191,665
		Decontamination	Thermal Destruction	50/cyd	121,916,650
Point No Point	2,734,583	Dredging	NA	5/cyd	13,672,915
		Decontamination	Sediment Washing	29/cyd	79,302,907
Newark	1,889,757	Dredging	NA	5/cyd	9,448,785
		Decontamination	Thermal Destruction	40/cyd	75,590,280
Kearny	770,70	Dredging	NA	5/cyd	3,851,850
		Decontamination	Sediment Washing	29/cyd	22,340,730
Arlington	103,704	Dredging	NA	5/cyd	518,520
		Decontamination	Sediment Washing	29/cyd	3,007,416
Total					459,404,218

¹ Costs for decontamination of sediment containing moderate to low levels of contamination are based on the federal standard of \$29/cyd. Decontamination of sediment containing higher levels of dioxin (e.g., 1 ppb TCDD) was assumed to cost between \$40 and \$50/cyd due to special materials handling protocols.

4.0 CHALLENGES

The following challenges need to be considered and coordinated prior to remedial option selection:

- *Resuspension and mobilization of contaminated sediments during dredging:* Sediment resuspension can be minimized using a silt curtain, environmental closed bucket clamshell dredge, innovative dredging techniques (cable-arm dredge), dredge under low flow conditions, tidal fluctuations, no barge overflow, etc..
- *Removal of highly dioxin-contaminated (approximately 60 ppm) sediment at depth:* Special handling procedures and health and safety precautions must be implemented during the dredging and processing of contaminated material (especially in Harrison Reach).
- *Recontamination of sediments in the target areas from Combined Sewer Overflows (CSOs) and other sources in the Passaic River:* The Contaminant Reduction Programs, including the Contaminant Assessment Reduction Program (CARP), CSO investigations, toxic tract down, Harbor Estuary Program (HEP), and other state, federal, and municipal programs will minimize the future contaminant loading in the Passaic River. However, it is unlikely that recontamination would result in non-HARS suitable material.
- *Air emissions (specifically mercury) and residual management of waste streams during decontamination of highly contaminated sediments:* Environmental monitoring requirements, as specified in NJDEP permits, would be required to minimize the release of any waste streams resulting from the decontamination technology(s).
- *Destruction of benthic fauna in the entire Passaic River:* Dredging technologies will result in the destruction of the already degraded benthic macroinvertebrate population. Ecological investigations reported low species richness and abundance in the population currently inhabiting

the Passaic River. Following the remedial actions, the benthic community should recover rapidly and would likely be characterized by a highly abundant and diverse population.

- *Minimization of impacts on fish population:* Fish may be captured within the Passaic River and released outside the dredging area. Since the dredging area will be localized, movement of the fish community would occur.
- *Dioxin land-source control at Lister Ave Site:* Remediation or source control of contaminated soils (containing high levels of dioxin at depth) and groundwater must be implemented to reduce possible recontamination of Passaic River sediments. Bulkheading and slurry walls are anticipated to be constructed adjacent to the riverine portion of the Site (pursuant to the Superfund program).
- *Funding:* A funding package must be developed for the remediation of Passaic River sediments. Stakeholders could include local (Newark), state (NJDEP, NJMR) and federal governments (EPA, USACE, DOE, NOAA, HUD), and Potential Responsible Parties (PRPs: CLH, Sherman Williams, Benjamin Moore.). Because WRDA currently authorizes environmental dredging in the Passaic River, congressional appropriations are necessary.

5.0 FUTURE STEPS

Contaminated sediment within all six federal navigation reaches of the six-mile study area of the Passaic River should be removed if there is sufficient regional interest and funding is then made available. A first level cost analysis of \$459,404,218 is projected for removal of all contaminated sediments within the 6 reaches. A segregated cost of \$251,670,815 is predicted for highly contaminated “hot spot” removal from Harrison Reach (Site). Future steps that are necessary to implement these remedial options include:

- Collection of additional chemical sediment data for a more accurate estimation of sediment removal in Arlington and Kearny Reaches. Sediment samples should be collected at depth to better delineate the contaminant concentrations to predict the actual volume of sediment to be removed;
- Verification of chemical concentrations at depth to confirm dredging depths specified in Table 2;
- Economic cost/benefit analysis;
- Evaluation of the contaminant migration modeling efforts and coordination with present RI/FS modeling approaches;
- Evaluation of the overall cost reduction in the navigational dredging program, as a result of an increased volume of sediment to be placed at the HARS;
- Evaluation of crossings (e.g., electrical or gas lines, air draft clearance, bridge footings);
- Preparation of a Remedial Action Plan;
- Development of a funding package;
- Reconnaissance of interested parties and congressional interests;

- Development of a public outreach strategy; and
- Development of briefing materials and packages.

6.0 APPROPRIATIONS PACKAGE